FACULTY OF ENGINEERING AND TECHNOLOGY

ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT

CERTIFICATE IN ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT CODE: 1250

ENGINEERING MATHEMATICS III

SPECIAL / SUPPLEMENTARY EXAMINATIONS

SERIES JANUARY 2016

PAPER DURATION 2HRS

INSTRUCTIONS TO CANDIDATES

Candidates must have answer Booklet, Mathematics Tables, Scientific Calculation, No Mobile Phone, Question one compulsory and any other two.

Question one:

(a) (i) Given that $a(x) = 4x$, $b(x) = x^2$ $C(x) = x-5$ and $d(x) = \sqrt{x}$

Find $f(x) = a\left(b(c[d(x)]\right)$ (2mks)

(ii) If $f(x) = x^2$ express as simply as possible $\frac{f(a+h) - f(a)}{h}$ $(h \neq 0)$

(b) (i) Prove from definition and series of e^x and e^{-x} that (2mks)

$\text{Sinh}x = x + \frac{x^3}{3!} + \frac{x^5}{5!} + \frac{x^7}{7!} + \text{------}$

(ii) If $\text{th}x = 1/3$ find e^{2x} (2mks)

(iii) If $2\text{ch}x + 4\text{sh}x = Ae^x + Be^{-x}$. Find A and B (3mks)

(c) Integrate:

(i) $I = \int x(3-2x)^4\, dx$ by putting

$2 = 3 - 2x$ (4mks)

(ii) $I = \int \frac{dx}{(3x+2)^2}$ (3mks)

(d) Determine the following

(i) $\int (3x^4 - 4x^{1/3} + 3)\, dx$ (3mks)

(ii) $\int 3\cos 2x\, dx$ (3mks)

(iii) Verify by integration that the area of the triangle formed by the line $y = 2x$, the ordinates.

$x = 0$ and $x = 6$ and the x- axis is 36 square units (3mks)

QUESTION TWO:

(a) (i) Given that f : x $\longrightarrow$ 5x + 1 and that g:x$\longrightarrow$ x2 express the composite function. fg and gf in their simp test possible firms. (3mks)

(ii) Given that f (x) = x^3 find

f (a + h) – f (a-b) (h≠ 0) (3mks)

(b) Given that f (x) = 25 – x^2 and that g(x) = $\sqrt{x}$ find where possible the values of

(i) gf (0) (2mks)

(ii) gf (4) (2mks)

(iii) gf (13) (3mks)

(c) (i) The domain of f is IR (where IR is a set of real numbers

f: x$\rightarrow$ 1 when x < 0 and

f : x$\rightarrow$ x^2 + 1 when x ≥ 0

sketch the graph of the function (3mks)

(ii) Given that f (x) = 10x and g (x) = x + 3. Find fg (x) and $(fg)^{-1}$ (x)

Verify that if b = fg (a) then $(fg)^{-1}$ (b) (4mks)

QUESTION THREE

(a) Using simpson's rule with 8 intervals, evaluate $\int_1^3 y\,dx$ where the values of y at regular intervals of x are given.

x	1.0	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
y	2.45	2.80	3.44	4.20	4.33	3.97	3.12	2.38	1.80

(12mks)

(b) (i) Find the are bounded by
$Y = 5 + 4x – x^2$, the x- axis and the ordinates x = 1 and x = 4 (3mks)

(ii) Given that volume of solid of revolution is given by $\int_a^b \pi y2\,dx$

By rotating about the x – axis. Find the volume of the solid generated by rotating about the x – axis, the are under y = 5cos2x from x = 0 to x = $\frac{x}{4}$

(5mks)

QUESTION FOUR

(a) (i) Find all first and second partial derivative of

2 $= 3x^2 + 2xy + 4y^2$ (3mks)

(ii) If $V^2 = X^2 + Y^2 + Z^2$ Show that

$$\frac{d^2v}{dx^2} + \frac{d^2v}{dy^2} + \frac{d^2v}{dz^2} = \frac{z}{v}$$ (8mks)

(b) (i) Determine the approximate are between the curve $y = x^3 + x^2 - 4x - 4$, the ordinates x = -3 and x = 3 and the x- axis by applying Simpsons rule. (3mks)

(ii) Compare the results of b(i) above with the true area obtained by Integration (6mks)

QUESTION FIVE

(a) Integrate each of the following as per method indicated

(i) $\bar{I} = \int x^2 ex\, dx$ by parts (3mks)

(ii) $\bar{I} = \int \frac{1}{(x + 1)^2 (x^2 + 4)}$ by partial fractions (5mks)

(iii) $\bar{I} = \int \text{Sin}^3 x dx$ by trigonometric formation (3mks)

(b) Evaluate the following

(c) $I = \int_1^2 \int_0^3 x^2 y dx dy$ (4mks)

(d) $I = 3 \int_1^3 \int_{-1}^1 \int_0^3 (x + 2y - 2) dx dy dz$ (5mks)